REMARKS

Amendments to the Specification

Table 3 on page 26 of the Subject Application is amended here to correct an obvious error. In Table 3, the temperatures were incorrectly listed as being in °C. In the amended Table 3, temperature units are corrected to °F. Applicants assert that, in view of the disclosure of the Subject Application, this error would be readily appreciated by one of skill in the art and that this amendment does not introduce any new matter into the Subject Application. Accordingly, Applicants request that the Examiner enter this amendment.

Claim Amendments

Claims 1-41 are presently pending in the Application. Claims 33-39 have been withdrawn by the Examiner as being drawing to a non-elected invention. In the Office Action, the Examiner allows claims 1-25, 40 and 41, rejects claims 26-30 and objects to claims 31 and 32 as being dependent on a rejected base claim, but indicates these claims would be allowable if rewritten in independent form.

As a preliminary matter, Applicants note that a Preliminary Amendment was filed on August 31, 2005 in the Subject Application. Although the Preliminary Amendment was mailed prior to the mailing of the present Office Action, the Preliminary Amendment was apparently not received by the Examiner until after the Examiner prepared the present Office Action. Since it does not appear that the amendments set forth in the Preliminary Amendment have been entered into the record, ***Applicants again request that the Examiner enter the amendments contained in the Preliminary Amendment with respect to claims 1, 25 and 32 and the specification (in addition to the present amendment), prior to further examination of the Subject Application.*** Although the Preliminary Amendment also contained amendments to claims 33, 36, 37 and new claims 42-44 (which depend from claims 33, 36, and 37, respectively), in view of the election of inventions discussed below, the entry of these amendments and new claims is not requested. In view of the Examiner's reasons for allowance, Applicants assert that claims 1-25, 40 and 41 remain in a condition for allowance in view of these amendments.

Further, in accordance with the U.S. Patent and Trademark Office amendment practice, the Applicants have listed the status identifier for claims 1, 25 and 32 as "not entered," as it appears that these amendment have not yet been entered by the Examiner, and have not presented the text of the claims in the listing of pending claims. However, for the Examiner's convenience, the Applicants attach hereto the text of the claims (with markings showing the changes made) having the status identifier "not entered." Applicants again request that these amendments be entered if the Examiner has not already done so. Should the Examiner have any questions regarding the foregoing, the Examiner is requested to contact the Applicants' undersigned representative.

In the present Response, claims 2, 14 and 33-39 are cancelled, claim 23 is amended to insert the word "at" before "a temperature" in the second line of the claims, and claim 26 is amended to more particularly recite the composition of the alloy as a claim element. Applicants assert that these amendments are within the scope of the disclosure of the Subject Application and that no new matter has been introduced into the Subject Application by the foregoing amendments. Accordingly, Applicants request that the Examiner enter these amendments into the record.

Phone Interview

Applicants' representative thanks the Examiner for the courtesy of a telephone interview on November 17, 2005 wherein the Frank et al. reference was discussed with respect to claim 26. Applicants' representative notes that no agreement was reached in the telephone interview.

Restriction Requirement

In the Office Action, the Examiner requires election between the following groups of claims:

I. Claims 1-32, 40 and 41; and

II. Claims 33-39.

Applicants hereby confirm the election of the claims of group I (i.e., claims 1-32, 40 and 41) made during a telephone conversion with Patrick Viccaro on August 29, 2005, without traverse. The non-elected claims are cancelled herein.

Claim Rejections/Objections

In the Office Action, the Examiner rejects claims 26-30 under 35 U.S.C. §103(a) as being unpatentable over Frank et al. (U.S. Patent No. 5,556,594) (herein after "Frank et al."). According to the Examiner, Frank et al. discloses process for treating a nickel base alloy including the steps of solution treating, cooling, and two-step aging, wherein the second aging step is at a lower temperature than the first aging step and wherein the times and temperatures of the steps recited in Frank et al. are within the ranges defined by the rejected claims. Specifically with respect to claim 30, the Examiner asserts that Frank et al. includes numerous examples wherein the alloys have a yield strength and elongation value within the presently claimed range. The Examiner acknowledges that Frank et al. does not disclose the stress rupture life of the alloys, but asserts that this property would be a consequence of the heat treatment imposed on the alloy. The Examiner also acknowledges that Frank et al. does not disclose the claimed composition. However, the Examiner asserts that the compositions treated in Frank et al. are Ni-based superalloys having high yield strength and resistance to pitting, crevice and stress corrosion cracking, which include some of the same properties desirable in the present invention. Consequently, the Examiner concludes that a *prima facie* case of obviousness is established between the disclosure of Frank et al. and the rejected claims.

Applicant respectfully traverses the rejection of claims 26-30. There are three basic criteria that must be met to establish a *prima facie* case of obviousness under United States patent law. First, there must be some suggestion or motivation, either in the references or in the knowledge generally available in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all of the claim limitations. *See* Manual of Patent Examining Procedure ("M.P.E.P.") § 2143. Further, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not in the applicant's disclosure. *Id.*

Applicants respectfully submit that a *prima facie* case of obviousness has not been established, for at least the reasons that there is no suggestion or motivation to modify the reference, one skilled in the art would have no reasonable expectation of success if the reference were modified as suggested by the Examiner, and the prior art does not teach all of the claim limitations.

First, Applicants submit that there is no suggestion or motivation in Frank et al. to modify the composition taught in Frank et al. to utilize the heat treatment disclosed in Frank et al. with a nickel-base alloy as set forth in claim 26. Claim 26 recites a nickel-base alloy comprising the following composition (with emphases added):

> "...up to 0.1 carbon, from 12 to 20 chromium, up to 4 molybdenum, up to 6 tungsten, from 5 to 12 cobalt, up to 14 iron, from 4 to 8 niobium, from 0.6 to 2.6 aluminum, from 0.4 to 1.4 titanium, from 0.003 to 0.03 phosphorus, from 0.003 to 0.015 boron, and nickel; wherein a sum of the weight percent of molybdenum and the weight percent of tungsten is at least 2 and not more than 8, and wherein a sum of atomic percent aluminum and atomic percent titanium is from 2 to 6, a ratio of atomic percent aluminum to atomic percent titanium is at least 1.5, and the sum of atomic percent aluminum and atomic percent titanium divided by atomic percent niobium is from 0.8 to 1.3..."

However, the broad composition taught in Frank et al. includes, among other things, from 7-12 molybdenum. *See* Table II at col. 5 of Frank et al. In addition, Frank et al. teaches that the levels of "chromium, molybdenum, niobium, titanium, aluminum and nickel are critically balanced to provide the uniquely outstanding combination of strength and corrosion properties characteristic of the alloy provided by the present invention." *See* Frank et al. at col. 6, line 65 to col. 7, line 2 (emphasis added). At col. 7, line 21- line 28, Frank et al. further teaches that "[t]his invention in part stems from the discovery that the elements niobium and titanium together with smaller amounts of aluminum in the critical proportions specified herein in relation to each other and to the elements chromium, molybdenum and nickel provide a high 0.2% yield strength...." (Emphasis added.)

As indicated above, the composition set forth in claim 26 requires the molybdenum content of the alloy to be, ***at most, 4%***. Since Frank et al. discloses use of the heat treatment in connection with an alloy having almost double the maximum amount of molybdenum as set forth in the claims, and further teaches that the chromium, molybdenum, niobium, titanium, aluminum and nickel are ***critically balanced*** to provide a uniquely outstanding combination of strength and corrosion properties characteristic of the alloy provided by the present invention, Applicants submit that Frank et al. ***actually teaches away*** from the invention as set forth in claim 26.

Notably, the ***only*** example of an alloy having a Mo content falling within the claimed range of 4% maximum in the Frank et al. reference (i.e., heat no. 348 in Table IIIA, which include 3.03% Mo) is indicated by Frank et al. as being a heat that is "outside the scope of the invention." *See* Frank et al. at col. 10, lines 28-29, and Table IIIA. Therefore Applicants respectfully assert that one skilled in the art would not be motivated to utilize the heat treatment taught in Frank et al. with the alloy as set forth in claim 26.

Further, while Frank et al. broadly discloses that aluminum content of the alloy disclosed in Frank et al. may range from trace to about 1%, ***Frank et al. specifically discourage the use of more than 0.5% aluminum***, and more particularly discourage the use of more than about 0.35% aluminum if good room temperature strength properties are to be achieved. For example, at col. 8, lines 10-16 Frank et al. teaches (with emphasis added) "[i]t has also been noted that above about 0.25%, that is at about 0.35% and above, aluminum does not appear to add but rather to detract from the yield strength at room temperature. Therefore, while up to about 1% aluminum can be present, for better results, particularly higher yield strength, aluminum is limited to no more than 0.5%."

As indicated above, however, the composition recited in claim 26 includes from ***0.6 to 2.6 percent aluminum***. Since Frank et al. specifically discourage the use of the claimed levels of aluminum to achieve good room temperature yield strength, one skilled in the art would not be motivated by Frank et al. to apply the heat treatment taught in Frank et al. to a nickel base alloy having the aluminum content as set for in claim 26. Notably, the ***only*** examples in Frank et al. wherein an alloy having an aluminum content falling within the range of 0.6 to 2.6 (i.e., heat no. 348 in Table IIIA, which has 0.59% Al, and heat no. 590, which has 1.08% Al) are indicated as being heats that are "outside the scope of the present invention." *See* Frank et al. at col. 10, lines 28-29, and Table IIIA.

Additionally, claim 26 recites, in part a method of heat treating a nickel-base alloy comprising:

> ...solution treating the nickel-base alloy ... for no greater than 4 hours at a solution temperature ranging from 1725°F to 1850°F;
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> ...
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> aging the solution treated nickel-base in a first aging treatment for no greater than 8 hours at a temperature ranging from 1365°F

to 1450°F; and
aging the nickel-base alloy in a second aging treatment for at least 8 hours at a second aging temperature, the second aging temperature ranging from 1150°F to 1300°F.

While Frank et al. generally discloses a process involving solution treating at a temperature ranging from 1800°F-2200°F, Frank et al. goes on to state that "[a]n optimum solution treating temperature is 1900°F. (1038 C.)." *See* Frank et al. at col. 8, lines 64-65. As discussed in the Subject Application, the inventors have observed that low notch-sensitivity, improved stress rupture life and elongations can results when the alloy is heat treated in a manner such that controlled amounts of δ-phase and/or η-phase precipitates are present in the grain boundaries. See paragraph [0038] of the Subject Application. Further, as discussed in the Subject Application at paragraph [0044], the inventors have observed that if the solution temperature is above about 1850°F, a less than desired amount of grain boundary precipitates may be retained in the alloy. Accordingly, the notch-sensitivity, elevated temperature stress-rupture life and ductility of the alloy can be detrimentally affected.

This effect is further illustrated in the attached Declaration of Mr. Richard L. Kennedy Under 37 C.F.R. §1.132 ("Declaration"), one of the inventors in the Subject Application. In the Declaration, Mr. Kennedy concludes that when an alloy having the composition as set forth in claim 26 is solution heat treated in accordance with the preferred solution heat treatment disclosed in Frank et al., (i.e., at 1900°F) *the resultant alloy has an extremely low stress rupture life and displays unacceptable notch brittle stress rupture behavior.*

More specifically, as can be seen from the data presented in Table 1 of the Declaration, when an alloy having a composition falling within the composition claimed in claim 26 was solution treated at 1900°F for 1 hour (i.e., using the solution treatment temperature described in Frank et al. as the "optimum solution treating temperature") and aged at a first aging temperature of 1450°F for 2 hours and second aging temperature of 1200°F for 8 hours (i.e., Sample 3 in Table 1 of the Declaration), the alloy had an unacceptably low stress rupture life as measured at 1300°F and 80 ksi of *0.4 hours* and behaved in a *notch brittle manner* (that is, the alloy failed at the notch). *See* Declaration at page 2. Further, as can be seen in Micrograph 1, which is a representative micrograph taken of this alloy after solution treating at 1900°F and aging as discussed above, no δ-phase and/or η-phase precipitates are observed in the grain boundaries of the alloy.

In contrast, alloys that were solution treated at 1750°F and 1800°F, respectively, followed by aging at a first aging temperature of 1450°F for 2 hours and second aging temperature of 1200°F for 8 hours (Samples 1 and 2, respectively, in Table 1 of the Declaration), had stress rupture lives as measured at 1300°F and 80 ksi in *excess of 300 hours* and behaved in a *notch ductile manner* (that is, the alloy had "low notch-sensitivity" as it did not fail at the notch). *See* Declaration at page 2. As can be seen in Micrograph 2, which is a representative micrograph taken of the alloy that was solution treated at 1750°F and aged as discussed above, δ-phase and/or η-phase precipitates are observed in the grain boundaries of the alloy.

Based on the data set forth in the Declaration, Mr. Kennedy concludes that, in contrast to the Examiner's assertion that a good stress rupture life would be a consequence of the heat treatment imposed on the alloy in Frank et al., use of the optimum solution temperature disclosed in Frank et al. (i.e., 1900°F) resulted in the formation of microstructure that was devoid of δ-phase and/or η-phase precipitates in the grain boundaries and, as a consequence of this microstructure, the alloy displayed extremely low stress rupture life and undesirable notch brittle behavior.

Moreover, while Frank et al. generally discloses a process involving solution treating at a temperature ranging from 1800°F -2200°F and an initial or primary aging treatment at about 1250°F to about 1450°F followed by a secondary aging at about 1100°F -1250°F (see Frank et al. at col. 8, line 61 to col. 9, line 18), ***none*** of the examples set forth in Frank et al. were processed using a heat treatment as set forth in claim 26. For example, Tables IV and IVA in Frank et al. lack any examples of alloys that were heat treated using, in the nomenclature of Frank et al., an "A2" heat treatment (i.e., 1800°F-1h/AC solution treatment followed by 1375°F-8h/FC/1150°F-8h/AC), an "A3" heat treatment (i.e., 1800-°F1h/AC solution treatment followed by 1450°F-8h/FC/1150°F-8h/AC), or an "A6" heat treatment (i.e., 1800-°F1h/AC solution treatment followed by 1400°F-8h/FC/1200°F-8h/AC). Accordingly, there is no data in Frank et al. that would provide motivation to one skilled in the art to select from the broadly recited process steps in Frank et al., the particular combination of a solution treatment and aging steps as set forth in claim 26 - that is, solution treating for no greater than 4 hours at a solution temperature ranging from 1725°F to 1850°F, followed by aging for no greater than 8 hours at a first temperature ranging from 1365°F to 1450°F and aging for at least 8 hours at a second aging temperature ranging from 1150°F to 1300°F.

As discussed in the Subject Application, the heat treatments set forth in the Subject Application may be useful in providing a nickel-base alloy having ***thermally stable*** mechanical properties and improved ***mechanical properties at elevated temperatures***. As discussed at paragraphs [0007] to [0008] of the Subject Application, many 718-type nickel-based alloys that are strengthened primarily with γ'' precipitates tend to have properties that degrade rapidly at temperatures at about 1200°F due to the transformation strengthening γ'' (Ni_3Nb) phase-precipitates into incoherent, non-strengthening δ-phase precipitates. However, as discussed at paragraph [0030] of the Subject Application, the inventors have found that by precipitating a controlled amount of δ–phase and/or η-phase precipitates having a desired morphology in the grain boundaries of an nickel-base alloy that includes γ'-phase precipitates and γ''-phase precipitates of a desired size distribution, alloys having improved stress rupture life and especially notch ductile behavior (i.e., low notch-sensitivity) may be achieved. Further, as discussed at paragraph [0048] of the Subject Application, after heat treating an alloy as recited in claim 26, the alloy desirably has a microstructure that is predominantly strengthened by γ'-phase precipitates and may comprise an amount of at least one grain boundary precipitate selected from δ-phase precipitates and η-phase precipitates, at least one of which has a short, generally rod-shaped morphology, which the inventors have found to be important to stress-rupture behavior.

In contrast, Frank et al. disclose that the alloys taught therein are heat treated to develop a microstructure that is strengthened with ***intragranular precipitates*** having the generalized composition $Ni_3(Nb, Ti, Al)$ and which may include γ' and/or γ'' phase precipitates. *See* Frank et al. a col. 8, lines 41 to 48. Frank et al. make no mention of forming controlled amounts of δ-phase and/or η-phase precipitates in the grain boundaries to improve the thermal stability of the alloys processed therein and do not disclose nickel-base alloys that are predominately strengthened by γ'-phase precipitates. Indeed, as discussed above, the optimum solution treatment temperature disclosed in Frank et al. is actually disadvantageous to the formation of δ-phase and/or η-phase precipitates.

Further, there is nothing in Frank et al. that suggests that the heat treatments taught therein could be useful in providing nickel-base alloy of any composition with ***a yield strength at***

1300°F of at least 120 ksi, etc. as set forth in claim 30. All of the data in Frank et al. is directed toward either ***room temperature mechanical properties***, such as yield and tensile strengths, or corrosion properties. Further, almost 25% of the samples for which data is reported in Table IV had ***a room temperature yield strength of 120.4 ksi or less***, and more than 50% of the samples for which data is reported in Table IVA had ***a room temperature yield strength of 120.4 ksi or less.*** Since one skilled in the art would expect that the yield strength would go down at elevated temperatures, in view of the data set forth in Frank et al. one skilled in the art would not be motivated to use the heat treatments taught therein to achieve an alloy having the properties such as those recited in claim 30.

Second, Applicants respectfully submit that, based on the disclosure in Frank et al., one skilled in the art would have no reasonable expectation that the heat treatment disclosed in Frank et al. could be successfully employed with a nickel-base alloy as set forth in claim 26, or further could be employed to achieve the properties recited in claim 30.

As discussed above, Frank et al. teaches that the room temperature yield strength of an alloy can be detrimentally affected by the inclusion of more than about 0.25% aluminum, that is about 0.35% aluminum and above. Since the alloy recited in claim 26 contains more than 0.35% aluminum, one skilled in the art would have no reasonable expectation of success that by utilizing the heat treatments taught in Frank et al. an alloy having good room temperature yields strength, let alone ***yield strengths of at least 120 ksi at 1300°F***, could be achieved.

Moreover, Frank et al. discloses at col. 15, lines 19-22 (with emphasis added), that "[y]ield strengths greater than 100 ksi (690 MN/m2), that is at least about 105 ksi (about 724.9 MN/m^2) are consistently provided with hardener contents greater than 3.5 a/o with niobium $\geq$ 3.0 w/o." Further, at col. 15, lines 31-39 Frank et al. notes (with emphasis added) that "[w]hen it is desired to provide consistently a minimum 0.2% yield strength of about 120 ksi (about 827 MN/m^2), niobium and titanium are adjusted proportionately in relation to each other so that as the percent by weight niobium is decreased from about 3.9 w/o to 3.0 w/o the minimum weight percent titanium is increased proportionately from 0.5 w/o to about 1.1 w/o...." Still further, at col. 15, lines 43-47, Frank et al. notes (with emphasis added) that "[a]nd as the weight percent of niobium is decreased from about 4.5 w/o to about 3.5 w/o the weight percent titanium is increased proportionately from 0.5 to 1.5 w/o, then a minimum 0.2% yield strength of about 140 ksi (about 965 MN/m^2) is attainable."

The alloy recited in claim 26 comprises from ***4 to 8 weight percent niobium.*** As indicated above, Frank et al. teaches that use of niobium in amounts greater than 3.0% consistently provide room temperature yield strengths of about 105 ksi, and that by ***lowering the content of niobium*** from 3.9% to 3.0% and from 4.5% to 3.5%, the yield strength of the alloys disclosed therein can be consistently ***increased*** to about 120 ksi and 140 ksi, respectively. Since Frank et al. clearly teaches that use of ***less than the claimed amount of niobium*** is desirable to achieve ***room temperature yield strength propertie***s such as yield strengths of at least 120 ksi., one skilled in the art would have no reasonable expectation based on the teaching in Frank et al. that by heat treating an alloy having from 4 to 8 weight percent niobium according to the methods taught in Frank et al. an alloy having ***1300°F mechanical properties*** as set forth in claim 30 (such as yield strength at 1300°F of at least 120 ksi) could be achieved.

Third, Applicants respectfully submit that Frank et al. fails to teach or disclose all of the limitations of claim 26-30. As discussed above, Frank et al. does not teach or suggest an alloy having the composition as set forth in claim 26. As discussed in the M.P.E.P. at §2144.05 (emphasis added):

> [i]n the case where the claimed ranges 'overlap or lie inside the ranges disclosed in the prior art,' a *prima facie* case of obviousness exists....Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties.

As an example of the later situation, the M.P.E.P. cites Titanium Metals Corp. of America v. Banner, 778 F.2d 775 (Fed. Cir. 1985), in which the Federal Circuit upheld a rejection of a claim directed to an alloying having 0.8% nickel, 0.3% molybdenum, up to 0.1% iron, balance titanium as obvious over a reference teaching an alloy having 0.75% nickel, 0.25% molybdenum, balance titanium and a reference teaching 0.94% nickel, 0.31% molybdenum, balance titanium.

As acknowledged by the Examiner and as indicated above, Frank et al. does not disclose the composition that overlaps the ranges set forth in claim 26. In particular, the alloy disclosed in Frank et al. contains ***almost double the maximum amount of molybdenum recited in claim 26.*** In view of the ***widely disparate*** amounts of molybdenum contained in the alloy disclosed in

Frank et al. and the alloy set forth in claim 26, and further in view of the teachings in Frank et al. that the amounts of chromium, molybdenum, niobium, titanium, aluminum, and nickel in the alloy of Frank et al. are ***critically balanced to provide the uniquely outstanding combination of room temperature strength and corrosion resistance properties that are characteristics of the alloy***, Applicants submit that one skilled in the art ***would not*** have expected the disclosed alloy and the claimed alloy to have the same properties.

In view of the foregoing, Applicants respectfully submit that a *prima facie* case of obviousness based on Frank et al. has not been established, and request that the Examiner reconsider and withdraw his rejection of claims 26-30 based on Frank et al.

In the Office Action the Examiner further rejects claims 26-30 under 35 U.S.C. §103(a) as being unpatentable over Sudo (U.S. Patent Application Publication No. 2003/0051777) (hereinafter "Sudo"). According to the Examiner, Sudo discloses an alloy having a composition as recited in claim 26 that is processed by solution treating followed by a two step aging process. The Examiner acknowledges that Sudo differs from the rejected claims in that the first aging temperature of Sudo is lower than the second aging temperature. However, according to the Examiner this deficiency is supplied by Sudo because at paragraph [0027], Sudo discloses that typical heat treatments for 718-type nickel base alloys involve a higher primary aging temperature than secondary aging temperature. Therefore, the Examiner concludes that the process set forth in claim 26 would have been well within the level of one of ordinary skill in the art.

As discussed above, in order to establish a *prima facie* case of obviousness under 35 U.S.C. §103(a), there must be some suggestion or motivation, either in the references or in the knowledge generally available in the art, to modify the reference or to combine the reference teachings; there must be a reasonable expectation of success; and the prior art references must teach or suggest all of the claim limitations. Further, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not in the applicant's disclosure.

Sudo discloses heat treating a 718-type nickel base alloy. However, as acknowledged by the Examiner, and in direct contrast to the process recited in claim 26, the heat treating process of Sudo involves a lower first aging temperature than the second aging temperature. In particular, as disclosed at paragraph [0030] of Sudo, the first aging temperature in Sudo ranges from 610 to 660°C (1130 to 1220°F) and the second aging temperature in Sudo ranges from 710 to 760°C (1310 to 1400°F), whereas claim 26 recites, in part:

> ...solution treating the nickel-base alloy ... for no greater than 4 hours at a solution temperature ranging from 1725°F to 1850°F;
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> ...
>
> aging the solution treated nickel-base in a first aging treatment for no greater than 8 hours at a temperature ranging from 1365°F to 1450°F; and
>
> aging the nickel-base alloy in a second aging treatment for at least 8 hours at a second aging temperature, the second aging temperature ranging from 1150°F to 1300°F.

Despite this clear distinction between the process recited in Sudo and the claimed process in claim 26, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to modify the teachings of Sudo to use a higher first aging temperature and a lower second aging temperature because Sudo discloses at paragraph [0027] that it is common practice in the art to use higher first aging temperatures and lower second aging temperatures.

Applicants respectfully submit, however, that there is ***no motivation or suggestion in Sudo, or in knowledge generally available in the art, to modify the teachings of Sudo as suggested by the Examiner***. In fact, Sudo actually ***teaches away*** from reversing the aging steps to use a higher first aging temperature and a lower second aging temperature as suggested by the Examiner. For example, at paragraph [0069] Sudo discloses that if the first aging temperature exceeds 660°C (i.e., 1220°F) large γ'' nuclei are formed and, "[a]s a result, the rate of giant precipitates having average diameters exceeding 1 μm is increased. As described above, the giant precipitates do not contribute to the improvement in the respective characteristics of the Ni based alloy...." Further, at paragraph [0072] Sudo discloses that if a second aging temperature of less than 710°C (i.e., 1310°F) is used, then insufficient precipitate growth may occur. Accordingly, Applicants respectfully assert that one skilled in the art ***would not be motivated to reverse the aging steps taught in Sudo*** in order to use a higher first aging temperature and a lower second aging temperature as suggested by the Examiner.

Further, it is clear from the teachings of Sudo discussed above that reversing the aging temperatures as suggested by the Examiner would render the invention of Sudo ***unsatisfactory for its intended purposes***. As discussed throughout Sudo, a critical aspect of the invention of Sudo is the development of a desired amount and size of precipitates within the nickel alloy. For example at paragraphs [0011]-[0013] Sudo states that

> [a] principal object of the present invention is to provide a Ni based alloy in which hardness, strength, and toughness are improved because of the presence of precipitates.... According to the present invention, there is provided an Ni base alloy...wherein the Ni base alloy includes not less than 700 first precipitates per μm^2 when observed two-dimensionally with a transmission electron microscope...and each of the first precipitates has a longer diameter of not less than 0.5 nm; and wherein the first precipitate includes a second precipitate having an average diameter of 25 nm to 1 μm....

As discussed above, Sudo directly links the formation of the desired amount and size of the precipitates to the use of a heat treatment involving a lower first aging temperature followed by a higher second aging temperature, and specifically states that if a first aging temperature that is higher than the disclosed range is used and/or a second aging temperature that is lower than the disclosed range is used, ***the desired microstructure will not be formed***. As discussed in M.P.E.P. §2143.01, "if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." Applicants respectfully assert that, since the modification proposed by the Examiner ***would render Sudo unsatisfactory for its intended purpose***, as a matter of law there is no motivation or suggestion to modify Sudo as suggested by the Examiner.

Similarly, Applicants submit that ***one skilled in the art could have no reasonable expectation*** that the modification to Sudo proposed by the Examiner would be successful in view of the teachings of Sudo to the contrary (as discussed above).

Further, although Sudo does disclose that 718-type nickel-base alloys are commonly heat treated using a higher first aging temperature and a lower second aging temperature, ***nowhere*** in Sudo does it teach or suggest that the common practice involves a first aging temperature as recited in claim 26, i.e., a first aging temperature ranging from 1365°F to 1450°F. As discussed at paragraph [0010] of the Subject Application (with emphases added) a typical precipitating hardening procedure for 718-type nickel-base alloys for high temperature service involves:

> solution treating the alloy at temperature of 1750°F for 1 to 2 hours, air cooling the alloy, followed by aging the alloy in a two-step aging process. The first aging step involves heating the alloy at a first aging temperature of 1325°F for 8 hours, cooling the alloy at about 50 to 100°F per hour to a second aging temperature of 1150°F, and aging the alloy at the second aging temperature for 8 hours. The precipitation-hardened microstructure that results after the above-described heat treatment is comprised of discrete γ' and γ"-phase precipitates, but is predominately strengthened by the γ"-phase precipitates with minor amounts of the γ'-phase playing a secondary strengthening role.

Accordingly, it can be seen that the common practice referred to in Sudo ***does not involve the use of a first aging temperature as set forth in claim 26***, but instead a first aging temperature that is ***substantially lower*** than that recited in claim 26. Accordingly, Applicants respectfully assert that Sudo ***fails to teach or suggest all of the claim limitation*** of claim 26, and therefore cannot form the basis of a *prima facie* case of obviousness under 35 U.S.C. §103(a).

Further, as discussed throughout the Subject Application, the inventors have found that by heat treating an alloy as taught therein, an alloy having one or more desirable, thermally stable properties can be achieved. For Example, in Example 2 of the Subject Application, data is provided for an alloy having a composition falling with the in the composition recited in claim 26 that was heat treated using a 1750°F solution treat for 1 hour, followed by a first aging treatment at 1325°F for 8 hours and a second aging treatment at 1150°F for 8 hours (i.e., Sample Group 5) and an alloy (having the same composition) that was heat treated using a 1750°F solution treatment for 1 hour, followed by a first aging treatment at 1450°F for 2 hours and a second aging treatment of 1200°F 8 hours (i.e., Sample Group 6) is provided in Example 2.

As can bee seen in the results in Table 4, and as discussed in paragraph [0070] of the Subject Application, while both Sample Group 5 and Sample Group 6 material achieved minimum properties such as yield strengths at 1300°F of at least about 120 ksi and stress rupture lives at 1300°F and 80 ksi of at least about 300 hours, the Sample Group 6 samples had generally improved properties, including a substantially increased stress rupture life at 1300°F and 80 ksi

(433.1 hours) as compared to the Sample Group 5 (386.2 hour). Further, as shown in Table 5 on page 27 of the Subject Application, repeat testing of additional samples of the same alloy that were processed using a 1750°F or 1800°F solution treatments for 1 hour, followed by a first aging treatment at 1450°F for 2 hours and a second aging treatment of 1200°F for 8 hours also displayed substantially improved stress rupture life values, 558.4 hours and 525.5 hours, respectively, as compared to those processed using a lower first aging temperature.

Further, while there is much discussion of the importance of the microstructure resulting from the heat treatment disclosed in Sudo, there is no teaching in Sudo of grain boundary δ- or η-phase precipitation or the importance of these precipitates in obtaining good stress rupture properties.

In view of the foregoing, Applicants respectfully submit that a *prima facie* case of obviousness based on Sudo has not been established, and request that the Examiner reconsider and withdraw his rejection of claims 26-30 based on Sudo.

Applicants further request that, in view of the foregoing, the Examiner reconsider and withdraw his rejection of claims 31 and 32 as being dependent upon a rejected base claim.

* * * * *

CONCLUSION

After entry of the present amendment, claims 1, 3-13, 15-32, 40 and 41 are pending in the Subject Application. The Examiner has previously indicated that claims 1, 3-25, 40 and 41 are in a condition for allowance. Applicants assert that these claims remain in a condition for allowance. Applicants further assert that claims 26-32 are also in a condition for allowance and request that the Examiner reconsider and allow the same.

If the Applicants' undersigned representative can be of any assistance to the Examiner in advancing the claims of the Subject Application to allowance, the Examiner is invited to call the Applicants' undersigned representative at the number indicated below.

Respectfully Submitted,

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Date

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Text of "Not Entered" Claims with Markings

1. (Not Entered) A method of heat treating a 718-type nickel-base alloy comprising:

pre-solution treating the nickel-base alloy wherein an amount of at least one grain boundary precipitate selected from the group consisting of δ-phase precipitates and η-phase precipitates is formed within the nickel-base alloy, the at least one grain boundary precipitate having a short, generally rod-shaped morphology;

solution treating the nickel-base alloy wherein substantially all γ'-phase precipitates and γ"-phase precipitates in the nickel-base alloy are dissolved while at least a portion of the amount of the at least one grain boundary precipitate is retained;

cooling the nickel-base alloy after solution treating the nickel-base alloy at a first cooling rate sufficient to suppress formation of γ'-phase and γ"-phase precipitates in the nickel-base alloy;

aging the nickel-base alloy in a first aging treatment wherein primary precipitates of γ'-phase and γ"-phase are formed in the nickel-base alloy; and

aging the nickel-base alloy in a second aging treatment wherein secondary precipitates of γ'-phase and γ"-phase are formed in the nickel-base alloy, the secondary precipitates being finer than the primary precipitates; and

wherein after heat treating the nickel-base alloy, the γ'-phase precipitates are predominant strengthening precipitates in the nickel-base alloy and a majority of the grain boundaries of the nickel-base alloy are pinned by at least one grain boundary precipitate.

25. (Not Entered) The method of claim 18 wherein after heat treating the nickel-base alloy, the nickel-base alloy comprises:

γ'-phase precipitates and γ"-phase precipitates, wherein the γ'-phase precipitates are predominant strengthening precipitates in the nickel-base alloy; and

an amount of ~~at least one~~ grain boundary ~~precipitate~~precipitates sufficient to pin the majority of the grain boundaries in the matrix, the grain boundary precipitates being selected from the group consisting of δ-phase precipitates~~and~~, η-phase precipitates, ~~wherein the at least one grain boundary precipitate has a~~and mixtures thereof, and having short, generally rod-shaped ~~morphology~~morphologies.

32. (Not Entered) The method of claim 31 wherein after heat treating the nickel-base alloy, the nickel-base alloy comprises:

γ'-phase precipitates and γ"-phase precipitates, wherein the γ'-phase precipitates are predominant strengthening precipitates in the nickel-base alloy; and

an amount of ~~at least one~~ grain boundary ~~precipitate~~precipitates sufficient to pin the majority of the grain boundaries in the matrix, the grain boundary precipitates being selected from the group consisting of δ-phase precipitates ~~and~~, η-phase precipitates, ~~wherein the at least one grain boundary precipitates has a~~and mixtures thereof, and having short, generally rod-shaped ~~morphology~~morphologies.